



Blackburn, R. M., Herbert, A., Wijlaars, L., & Gilbert, R. (2018). Trends in Hospital Admissions for Nonfatal Adversity-Related Injury Among Youths in England, 2002-2016. *JAMA Pediatrics*, 172(11), 1095-1097. <https://doi.org/10.1001/jamapediatrics.2018.2516>

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Manuscript Title: Trends in hospital admissions for non-fatal self-inflicted, drug/alcohol-related or violent injury in young people aged 10 to 24 years in England, 2002-2016.

Word count: 600 words

Background

Recent increases in health care contacts for self-inflicted injury have been reported for females but not for males in the United States (US) and England. In the US, rates of emergency department attendances for non-fatal self-inflicted injury increased in females aged 10-19 (2009-2015) and 15-19 years (2008-2015).¹ In England, annual incidence rates of self-inflicted injury in primary care increased from 2011 to 2014 for females aged 13-16 years.² Four percent of all males and females aged 10-19 years have had an emergency hospital admission with a non-fatal adversity-related injury (ARI) – reflecting mutually exclusive groups of self-inflicted injuries (coded as *intentional* “self-harm” or “self-poisoning”), injury admissions related to drug and alcohol-use (excluding intentional alcohol/drug self-poisoning), or violence.³ Increasing rates of ARIs in England among girls, but not boys, have been previously reported, but not for older adolescents (aged 20-24 years) or for recent years⁴. We analysed temporal trends in non-fatal ARI admissions overall and for self-inflicted injury among young people in England.

Methods

We analysed Hospital Episode Statistics records for all emergency (acute, unplanned) injury admissions³ to the National Health Service in England (from 2002-2016 inclusive) for ages 10 to 24 years (n=2,017,117). Annual incidence of emergency admissions with ARI, the subset relating to self-inflicted injury, and injuries with no recorded ARI, were calculated using Office for National Statistics mid-year population estimates as denominators. Patients who died during admission (n=3,625; of whom 956 had an ARI, of which 492 were self-inflicted injury) were excluded. Joinpoint regression (see Table 1) was used to estimate the annual

percentage change in the rate of ARI and self-inflicted injury admissions (per 100,000 population) throughout the study period.

Results

ARI admissions accounted for 35% (n=422,692) of all emergency injury admissions in males and 65% (n=482,927) in females. Self-inflicted injury accounted for 39% (n=164,684) of ARI admissions in males, and 81% (n=392,526) in females.

The rate of emergency admissions with any ARI has fluctuated over time, with striking variation by age and sex (**Table 1, Figure 1**). Rates increased in all age and sex groups between 2002 and 2004. Since 2012, the rate of admission with any ARI increased by 3% per year in males aged 10-14 years, but declined by 4-5% per year in males aged 15-19 and 20-24 years. In contrast, ARI rates in females aged 10-14 years declined (at a rate of 7% per year) during 2014-2016, but remain higher than before 2012. The rate of ARI admissions has increased most (6% per year since 2012) for females aged 15-19 years, and has remained almost constant (0.2% increase per year) for 20-24 year olds.

For females, the magnitude and temporal pattern of self-inflicted injury closely mirrored those for any ARI. However, for males aged 15-19 years there was a 1% increase per year (2008 to 2016) in self-inflicted injury admissions, which contrasted with declining rates for any ARI (**Table 1**).

Discussion

We find recent increases in rates of admission with ARIs – including intentional self-injury – in females, with the greatest increase (6% per year since 2012) in 15-19 year olds. These changes are consistent with increases reported in the US (in emergency department visits

for self-inflicted injury) and English primary care consultations for self-inflicted injury.^{1,2} The consistent increases across all age and sex groups between 2002-4 suggest growing recognition and/or coding. However, subsequent changes - divergent between age and sex groups – may indicate a growing problem, particularly for females, and for intentional self-injury in males aged 15-19 years. Further research is needed to determine how early preventative interventions in community services (schools, family and neighbourhood interventions, primary care) can impact on presentations to hospital.⁵⁻⁶

Acknowledgements

This study was funded by the Policy Research Unit in the Health of Children, Young People and Families (reference 109/00017), which is funded by the Department of Health Policy Research Programme. This article represents independent research funded by the Department of Health. The views expressed in this publication are those of the author(s) and not necessarily those of the Department of Health. We thank Arturo González-Izquierdo for advice on data, Helen Roberts for comments, and the co-directors Catherine Law and Terence Stephenson of the Policy Research Unit in the Health of Children, Young People and Families. We also acknowledge the support from the Farr Institute of Health Informatics Research at University College London Partners from the Medical Research Council and a consortium of funders (MR/K006584/1).

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Figure 1 Title: Figure 1: Emergency admission rates (per 100,000) with any adversity-related injury (ARI) (in males (left) and females (right)) aged 10 to 24 years in England, 2002 to 2016.

Figure 1 Legend: Note. Each data point (connected by dashed lines) indicates the observed rate of emergency admissions with ARI. Solid coloured lines indicate modelled rates.

Table 1: Trends in emergency admission rates (per 100,000) with any adversity-related injury (ARI) among young people aged 10 to 24 years in England, 2002 to 2016.

Sex	Age (years)	2002	2016	Time period 1 ^a	Time period 2 ^a	Time period 3 ^a
		N (Rate)	N (Rate)	Period (Annual Change ^b)	Period (Annual Change ^b)	Period (Annual Change ^b)
Any Adversity-Related Injury (ARI)						
Male	10-14	1,752 (99.1)	1,593 (96.1)	2002-2004 (13%)	2004-2012 (-5%)	2012-2016 (3%)
	15-19	7,074 (419)	9,198 (533)	2002-2004 (19%)	2004-2007 (5%)	2007-2016 (-4%)
	20-24	9,255 (574)	13,624 (705)	2002-2004 (18%)	2004-2010 (2%)	2010-2016 (-5%)
Femal e	10-14	3,807 (226)	6,418 (406)	2002-2011 (0.3%)	2011-2014 (18%)	2014-2016 (-7%)
	15-19	8,088 (505)	19,438 (1188)	2002-2005 (15%)	2005-2012 (2%)	2012-2016 (6%)
	20-24	5,170 (320)	13,229 (720)	2002-2005 (17%)	2005-2010 (4%)	2010-2016 (0.2%)
Any Self-Inflicted Injury						
Male	10-14	565 (32.0)	814 (49.1)	2002-2004 (9%)	2004-2010 (- 11%)	2010-2016 (3%)
	15-19	2,243 (133)	4,775 (277)	2002-2005 (13%)	2005-2008 (3%)	2008-2016 (1%)
	20-24	3,274 (203)	6,267 (324)	2002-2004 (13%)	2004-2010 (6%)	2010-2016 (-2%)
Femal e	10-14	2,735 (162)	5,847 (370)	2002-2011 (2%)	2011-2014 (22%)	2014-2016 (-8%)
	15-19	6,259 (390)	17,652 (1079)	2002-2005 (15%)	2005-2011 (4%)	2011-2016 (7%)
	20-24	3,884 (240)	10,948 (596)	2002-2005 (17%)	2005-2010 (5%)	2010-2016 (0.9%)

95% confidence intervals are not presented as they were too narrow to convey any useful information.

^a Linear splines with 0, 1 or 2 knots were used to model trends in ARI rates. Akaike's Information Criterion guided model selection for all knot-placements ≥ 2 years apart, and the log-likelihood ratio test used to indicate superior fit for equivalent Poisson and negative binomial models. In all instances a negative binomial regression model with 2 knot spline had best fit.

^b Annual Change in ARI admission rates was estimated using a regression model with the number of emergency ARI admissions as the outcome and population denominator as an offset.